



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE

United States Patent and Trademark Office

Address: COMMISSIONER FOR PATENTS

P.O. Box 1450

Alexandria, Virginia 22313-1450

www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/566,473	01/31/2006	Naoki Sugiura	285396US0PCT	5684
22850	7590	11/27/2009		
OBLON, SPIVAK, MCCLELLAND MAIER & NEUSTADT, L.L.P. 1940 DUKE STREET ALEXANDRIA, VA 22314				
EXAMINER				
SYKES, ALTREV C				
ART UNIT		PAPER NUMBER		
1794				
NOTIFICATION DATE		DELIVERY MODE		
11/27/2009		ELECTRONIC		

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

patentdocket@oblon.com

oblonpat@oblon.com

jgardner@oblon.com

Office Action Summary

Application No.

10/566,473

Applicant(s)

SUGIURA ET AL.

Examiner

ALTREV C. SYKES

Art Unit

1794

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 02 July 2009.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-11 and 16-24 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-11 and 16-24 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO/GS/US)
Paper No(s)/Mail Date 20091009
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date _____
- 5) ☐ Notice of Informal Patent Application
- 6) ☐ Other: _____

DETAILED ACTION

Response to Arguments

1. Applicant's arguments filed July 2, 2009 have been fully considered but they are not completely persuasive.

Applicant argues that Hirai et al. in Col 4, lines 7-21 and Col 7, lines 41-50 does not disclose or suggest a sizing agent having a polymer backbone of carbon-carbon bonds.

After review of the Hirai et al. prior art the examiner is not persuaded that the Hirai et al. reference does not suggest a sizing agent having a polymer backbone of carbon-carbon bonds. The sizing agent may be a thermoplastic resin, a thermosetting resin or a mixture thereof. (See Col 4, lines 7-10) Examiner notes that applicant discloses an acid modified polypropylene resin would be exemplary of a sizing agent meeting the acid value as recited in claim 1. (See instant specification pgs 16, lines 14-20) Therefore, by applicants own admission, a polypropylene meets the limitation of a polymer with a backbone of carbon-carbon bonds. Hirai et al. discloses examples of the thermoplastic resin which can be used as a matrix include polyolefin resins and acid modified polyolefin resins. (See Col 7, lines 22-35) As such, examiner notes that one of ordinary skill in the art at the time of the invention would have been easily motivated to use a well known polyolefin such as polypropylene for the thermoplastic resin sizing agent.

Applicants argues that nowhere does Hirai disclose or suggest the specific combination of an epoxy presize followed by a size treatment according to claim 1.

After review of the Hirai et al. prior art the examiner agrees with applicant that Hirai et al. does not specifically disclose the specific combination of an epoxy presize followed by a size treatment according to claim 1. Therefore, the rejection of claims 1, 2 and 10 under 35 U.S.C. 102(b) has been withdrawn.

However, such a combination would have been obvious to one of ordinary skill in the art at the time of the invention since Hirai et al. discloses when the sizing agent is applied two or more times to the strand, either the same kind or different kinds of sizing agents can be applied. (See Col 6, lines 32-34) The sizing agent may be a thermoplastic resin, a thermosetting resin or a mixture thereof at any proportion including epoxy resins, modified forms of such resins, polyolefin resins and acid modified polyolefin resins. (See Col 4, lines 7-21 and Col 7, lines 41-50) Therefore, it would have been well within the ordinary skill of one in the art at the time of the invention to utilize an epoxy resin followed by an acid modified polyolefin resin motivated by the desire to provide a reinforcing material for short fiber reinforced molded articles, easy to handle and excellent in dispersibility in a matrix material. (See Col 1, lines 15-20)

Additionally regarding the process limitation of a presize, examiner notes that Hirai et al. discloses that a mixture of sizing agents may be used. (See Col 4, line 21) Therefore, one of ordinary skill in the art at the time of the invention would have been easily motivated

by expected success to utilize the sizing agents one after another consecutively instead of simultaneously in order to provide for the completely expected result of improving the adhesion of the carbon bundle to the thermoplastic matrix thereby improving the final composite products. It has been well settled that selection of any order of performing process steps is prima facie obvious in the absence of new or unexpected results See *In re Burhans*, 154 F.2d 690, 69 USPQ330 (CCPA 1946)

Applicant argues Hasegawa et al. does not cure the deficiency of Hirai et al. to disclose or suggest a relationship between carbon fiber bundle sizing performance and acid value. Applicant argues that neither cited reference discloses or suggests an acid modified polypropylene resin having a weight average molecular weight of 45,000 or less and an acid value of 23 to 120 mg KOH/g.

Examiner is not persuaded and will clarify the position taken. Hasegawa et al. discloses a sizing agent of an acid modified polypropylene resin to be applied to inorganic fiber bundles. (See Abstract and [0004]) Hasegawa et al. discloses the inorganic fiber may be carbon fiber. (See [0022]) Hasegawa et al. discloses the number average molecular weight of the polypropylene system resin was 500-20,000. (See [0007]) Therefore, examiner notes that the average molecular weight as claimed by applicant is met by the prior art. Hasegawa et al. discloses the acid modified polypropylene emulsion may be used alone or may consist of other sizing agents such as vinyl-acetate-resin emulsions,

etc. (See [0020]) Therefore, the limitation of at least 35 wt% of an acid modified polypropylene resin sizing agent as claimed is met when the acid modified polypropylene emulsion is used alone and would be easily modified by one of ordinary skill in the art when used together with other sizing agents as suggested by Hasegawa. Further, as the combined references of Hirai et al. and Hasegawa et al. acknowledge the use of a mixture of sizing agents for a carbon fiber bundle, one of ordinary skill in the art at the time of the invention would have been easily motivated by expected success of improving dispersibility of the bundle to utilize the sizing agents in a 1:1 or (50/50) ratio. Finally, as the limitation of an acid modified polypropylene resin having a weight average molecular weight of 45,000 or less has been met by the prior art, one of ordinary skill in the art would readily expect that an acid value of 23 to 120 mg KOH/g would be exhibited by the sizing agent.

Applicant argues that only in hindsight would one of ordinary skill in the art combine the cited references and identify the claimed acid value.

Examiner is not persuaded and maintains the position as set forth above. Additionally, it is noted that Hirai et al. and Hasegawa et al. are both in the same field of endeavor. In response to applicant's argument that the examiner's conclusion of obviousness is based upon improper hindsight reasoning, it must be recognized that any judgment on obviousness is in a sense necessarily a reconstruction based upon hindsight reasoning. But so long as it takes into account only knowledge which was within the level of

ordinary skill at the time the claimed invention was made, and does not include knowledge gleaned only from the applicant's disclosure, such a reconstruction is proper. See *In re McLaughlin*, 443 F.2d 1392, 170 USPQ 209 (CCPA 1971).

Applicant argues nowhere does Rieux disclose or suggest a copolymer obtained by copolymerizing ethylene or propylene and an epoxy containing monomer.

Examiner is persuaded. However, the rejection is maintained in view of newly found prior art and a different interpretation of the previously applied art as set forth below.

Applicant argues Sugiura and Ikeda fail to cure the deficiencies of the combination of references and cannot render claims 8, 11, 16, 22 and 24 obvious.

Examiner is not persuaded in view of the positions as set forth above. Examiner also notes that applicant has not pointed out any particular deficiencies of the Sugiura and Ikeda references. The rejections are now as set forth below.

Claim Rejections - 35 USC § 103

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

3. The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:
 1. Determining the scope and contents of the prior art.
 2. Ascertaining the differences between the prior art and the claims at issue.
 3. Resolving the level of ordinary skill in the pertinent art.
 4. Considering objective evidence present in the application indicating obviousness or nonobviousness.
4. Claims 1-2 and 10 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hirai et al. (US 5,227,238).

Regarding claims 1 and 2 Hirai et al. discloses carbon fiber chopped strands which are suitable for use as a reinforcing material for short fiber reinforced molded articles, easy to handle and excellent in dispersibility in a matrix material. (See Col 1, lines 15-18) Hirai et al. discloses the carbon fiber strand is preferably constituted of from 1,000 to 100,000 filaments. (See Col 3, lines 63-64) Hirai et al. discloses the sizing agent may be either a thermoplastic resin, a thermosetting resin or a mixture thereof at any proportion including epoxy resins, urethane-modified epoxy resins, polyester resins, polyurethane resins, polycarbonate resins, polyetherimide resins, epoxy-modified urethane resins, and modified forms of the above resins (a part of the terminal residues of a polymer or a part of the side chains of a polymer are modified, for example, a polyolefin is grafted with acrylic acid or maleic acid) or mixtures thereof. (See Col 4, lines 7-21) As such, examiner notes that a polymers having modified side chains is taught by the prior art. Hirai et al. discloses the sizing agent may be a thermoplastic resin, a thermosetting resin

or a mixture thereof. (See Col 4, lines 7-10) Examiner notes that applicant discloses an acid modified polypropylene resin would be exemplary of a sizing agent meeting the acid value as recited in claim 1. (See instant specification pgs 16, lines 14-20) Therefore, by applicants own admission, a polypropylene meets the limitation of a polymer with a backbone of carbon-carbon bonds. Hirai et al. discloses examples of the thermoplastic resin which can be used as a matrix include polyolefin resins and acid modified polyolefin resins. (See Col 7, lines 22-35) As such, examiner notes that one of ordinary skill in the art at the time of the invention would have been easily motivated to use a well known polyolefin such as polypropylene for the thermoplastic resin sizing agent.

Regarding the process limitation of a presize, examiner notes that Hirai et al. discloses that a mixture of sizing agents may be used. (See Col 4, line 21) Examiner also notes that an epoxy sizing agent is disclosed in Hirai. Therefore, one of ordinary skill in the art at the time of the invention would have been easily motivated by expected success to utilize the sizing agents one after another instead of simultaneously in order to provide for the completely expected result of improving the adhesion of the carbon bundle to the thermoplastic matrix thereby improving the final composite products. It has been well settled that selection of any order of performing process steps is prima facie obvious in the absence of new or unexpected results See *In re Burhans*, 154 F.2d 690, 69 USPQ330 (CCPA 1946)

Regarding claims 1 and 2, examiner notes that the claims contain product-by-process limitations. As such, the patentability of a product does not depend on its method of production. *In re Thorpe*, 227 USPQ 964, 966 (Fed. Cir. 1985). Hirai et al. carbon fiber chopped strands which are suitable for use as a reinforcing material for short fiber reinforced molded articles, easy to handle and excellent in dispersibility in a matrix material. (See Col 1, lines 15-18)

Regarding claim 10, Hirai et al. discloses carbon fiber chopped strands are bundled by a sizing agent in an amount of from 1 to 10% by weight. (See Col 3, lines 11-15)

5. Claims 1-6, 9, 10, 20 and 22 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hirai et al. (US 5,227,238) in view of Hasegawa et al. (JP 06-107442).

Regarding claims 1-3 and 6 Hirai et al. discloses all of the claim limitations as set forth above. Hirai et al. further discloses that the sizing agent may be a polyolefin grafted with acrylic acid or maleic acid. (See Col 4, lines 17-21) However, the reference does not specifically disclose at least 35% of an acid modified polypropylene resin having a weight average molecular weight of 45,000 or less and an acid value of 23 to 120 mgKOH/g.

Hasegawa et al. discloses a sizing agent of an acid modified polypropylene resin to be applied to inorganic fiber bundles. (See Abstract and [0004]) Hasegawa et al. discloses

the inorganic fiber may be carbon fiber. (See [0022]) Hasegawa et al. discloses the number average molecular weight of the polypropylene system resin was 500-20,000. (See [0007]) Therefore, examiner notes that the average molecular weight as claimed by applicant is met by the prior art. Hasegawa et al. discloses maleic acid may be used to modify the polypropylene resin. (See [0011]) Hasegawa et al. discloses the acid modified polypropylene emulsion may be used alone or may consist of other sizing agents such as vinyl-acetate-resin emulsions, etc. (See [0020]) Therefore, the limitation of at least 35 wt% of an acid modified polypropylene resin sizing agent as claimed is met when the acid modified polypropylene emulsion is used alone and would be easily modified by one of ordinary skill in the art when used together with other sizing agents as suggested by Hasegawa. Further, as the combined references of Hirai et al. and Hasegawa et al. acknowledge the use of a mixture of sizing agents for a carbon fiber bundle, one of ordinary skill in the art at the time of the invention would have been easily motivated by expected success of improving dispersibility of the bundle to utilize the sizing agents in a 1:1 or (50/50) ratio. Finally, as the limitation of an acid modified polypropylene resin having a weight average molecular weight of 45,000 or less (and 20,000 or less) has been met by the prior art, one of ordinary skill in the art would readily expect that an acid value of 23 to 120 mg KOH/g (and 40 to 75 mg KOH/g) would be exhibited by the sizing agent. Hasegawa et al. discloses the coating weight of a sizing agent is usually between 0.5 to 10%. (See [0023])

As Hirai et al. and Hasegawa et al. are both directed to sizing agents for carbon fibers, the art is analogous. Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention motivated by expected success to utilize the acid modified polypropylene resin as taught by Hasegawa et al. as the chosen acid modified polyolefin resin as disclosed by Hirai et al. in order to provide the completely expected result of a sized carbon fiber since Hasegawa et al. showed success. Examiner notes that one skilled in the art would have recognized polypropylene as a readily known polyolefin.

Regarding claims 4, 5 Hirai et al. discloses urethane-modified epoxy resins, and epoxy-modified urethane resins may be used in any proportion. (See Col 4, lines 7-21)

Examiner equates the said modified resins to the olefin-based thermoplastic elastomer resin as claimed by applicant. Hasegawa et al. disclose other sizing agents may be used together with the acid modified polypropylene resin such as a urethane resin emulsion, an acrylic resin emulsion, and an epoxy resin emulsion. (See [0021])

Hirai et al. and Hasegawa et al. both fail to teach at least 5 wt% of an olefin -based thermoplastic elastomer resin is used. It would have been obvious to one of ordinary skill in the art at the time the invention was made to optimize the resin amount since it has been held that, where the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation. *In re Aller*, 220 F.2d 454, 456, 105 USPQ 233, 235 (CCPA 1955). The burden is upon the Applicant to demonstrate that the claimed resin amount is critical and has unexpected

results. In the present invention, one would have been motivated to optimize the resin amount motivated by the desire to tailor the properties of the final carbon fiber bundle. Hirai et al. discloses the chopped strands have both a high bundling degree and high dispersibility. (See Col 3, lines 40-43) Hasegawa et al. discloses a sizing agent which would enhance the compatibility with the fiber reinforced resin. (See [0030]) As such, examiner has reason to believe that the modified resins of Hirai et al. (i.e. urethane-modified epoxy resin) would provide the claimed Vicat softening point as claimed by applicant, there being no showing of record to prove otherwise.

Regarding claim 9 and 22, Hasegawa et al. discloses the use of a silane coupling agent such as aminosilanes, epoxysilane, and arylsilanes. (See [0021]) Hasegawa et al. discloses the coating weight of a sizing agent is usually between 0.5 to 10%. (See [0023]) Hirai et al. and Hasegawa et al. both fail to teach at 5 wt% or less of silane coupling agent is used. It would have been obvious to one of ordinary skill in the art at the time the invention was made to optimize the silane coupling agent amount since it has been held that, where the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation. *In re Aller*, 220 F.2d 454, 456, 105 USPQ 233, 235 (CCPA 1955). The burden is upon the Applicant to demonstrate that the claimed silane coupling agent amount is critical and has unexpected results. In the present invention, one would have been motivated to optimize the silane coupling agent amount motivated by the desire to tailor the properties of the

final carbon fiber bundle to have increased compatibility with the matrix resin. (See Hasegawa [0030])

Regarding claim 10, Hirai et al. discloses carbon fiber chopped strands are bundled by a sizing agent in an amount of from 1 to 10% by weight. (See Col 3, lines 11-15)

Regarding claim 20, Hasegawa et al. discloses that the acid for modifying the polypropylene resin includes unsaturated dicarboxylic acid, fumaric acid, mesaconic acid, and itaconic acid as well as maleic anhydride, itaconic acid anhydride, anhydrous citraconic acid and mixtures thereof. (See [0011]) Hasegawa et al. disclose other sizing agents may be used together with the acid modified polypropylene resin such as a urethane resin emulsion, an acrylic resin emulsion, and an epoxy resin emulsion. (See [0021]) Hasegawa et al. also discloses that the emulsions may be used together. (See [0021]) Therefore, examiner notes that a compound as claimed by applicant to contain ethylene or propylene, acrylic ester, and an acid anhydride group would have been well within the ordinary skill of one in the art in view of the Hirai et al. and Hasegawa et al. disclosures since the use of more than one resin, whether thermoplastic or thermosetting, modified or not are all contemplated by the prior art.

6. Claims 1-2 and 10 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hirai et al. (US 5,227,238) in view of Rieux et al. (US 3,806,489).

Regarding claims 1 and 2 Hirai et al. discloses the claim limitations as set forth above. Hirai et al. further discloses that a mixture of sizing agents may be used. (See Col 4, line 21) Examiner also notes that an epoxy sizing agent is disclosed in Hirai. Hirai et al. does not specifically disclose a pre-sizing agent consisting of an epoxy resin followed by a sizing agent as recited in claim 1.

Rieux et al. discloses carbon fibers which have been previously sized with epoxy resins of the elastomer type. The sizing agent improves the properties of the composite by functioning as a tension damper between the matrix and the reinforcement. (See Col 2, lines 53-62 and Col 3, lines 33-37)

As Hirai et al. and Rieux et al. are both directed to sizing agents for carbon fibers, the art is analogous. Therefore, one of ordinary skill in the art at the time of the invention would have been easily motivated by expected success to utilize the sizing agents of Hirai et al. one after another instead of simultaneously in order to provide for the completely expected result of improving the adhesion of the carbon bundle to the thermoplastic matrix as taught by Rieux et al. thereby improving the final composite products. It has been well settled that selection of any order of performing process steps is prima facie obvious in the absence of new or unexpected results See *In re Burhans*, 154 F.2d 690, 69 USPQ330 (CCPA 1946)

Further regarding claim 2, examiner notes that the claim contain product-by-process limitations. As such, the patentability of a product does not depend on its method of production. *In re Thorpe*, 227 USPQ 964, 966 (Fed. Cir. 1985). Hirai et al. carbon fiber chopped strands which are suitable for use as a reinforcing material for short fiber reinforced molded articles, easy to handle and excellent in dispersibility in a matrix material. (See Col 1, lines 15-18) Rieux et al. discloses the sizing agent improves the properties of the composite by functioning as a tension damper between the matrix and the reinforcement. (See Col 2, lines 53-62)

Regarding claim 10, Hirai et al. discloses carbon fiber chopped strands are bundled by a sizing agent in an amount of from 1 to 10% by weight. (See Col 3, lines 11-15)

7. Claims 1-6, 9, 10, 20, 22 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hirai et al. (US 5,227,238) in view of Rieux et al. (US 3,806,489) as applied to claim 1 above and further in view of Hasegawa et al. (JP 06-107442).

Regarding claim 1-3, modified Hirai et al. discloses the claim limitations as set forth above. However, the combined references do not specifically disclose an acid modified polypropylene resin having a weight average molecular weight of 45,000 or less.

Hasegawa et al. discloses a sizing agent of an acid modified polypropylene resin to be applied to inorganic fiber bundles. (See Abstract and [0004]) Hasegawa et al. discloses

the inorganic fiber may be carbon fiber. (See [0022]) Hasegawa et al. discloses the number average molecular weight of the polypropylene system resin was 500-20,000. (See [0007]) Therefore, examiner notes that the average molecular weight as claimed by applicant is met by the prior art. Hasegawa et al. discloses maleic acid may be used to modify the polypropylene resin. (See [0011]) Hasegawa et al. discloses the acid modified polypropylene emulsion may be used alone or may consist of other sizing agents such as vinyl-acetate-resin emulsions, etc. (See [0020]) Therefore, the limitation of at least 35 wt% of an acid modified polypropylene resin sizing agent as claimed is met when the acid modified polypropylene emulsion is used alone and would be easily modified by one of ordinary skill in the art when used together with other sizing agents as suggested by Hasegawa. Further, as the combined references of Hirai et al. and Hasegawa et al. acknowledge the use of a mixture of sizing agents for a carbon fiber bundle, one of ordinary skill in the art at the time of the invention would have been easily motivated by expected success of improving dispersibility of the bundle to utilize the sizing agents in a 1:1 or (50/50) ratio. Finally, as the limitation of an acid modified polypropylene resin having a weight average molecular weight of 45,000 or less (and 20,000 or less) has been met by the prior art, one of ordinary skill in the art would readily expect that an acid value of 23 to 120 mg KOH/g (and 40 to 75 mg KOH/g) would be exhibited by the sizing agent. Hasegawa et al. discloses the coating weight of a sizing agent is usually between 0.5 to 10%. (See [0023])

As Hirai et al. and Hasegawa et al. are both directed to sizing agents for carbon fibers, the art is analogous. Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention motivated by expected success to utilize the acid modified polypropylene resin as taught by Hasegawa et al. as the chosen acid modified polyolefin resin as disclosed by Hirai et al. in order to provide the completely expected result of a sized carbon fiber since Hasegawa et al. showed success. Examiner notes that one skilled in the art would have recognized polypropylene as a readily known polyolefin.

Regarding claims 4 and 5 Hirai et al. discloses urethane-modified epoxy resins, and epoxy-modified urethane resins may be used in any proportion. (See Col 4, lines 7-21) Examiner equates the said modified resins to the olefin-based thermoplastic elastomer resin as claimed by applicant. Hasegawa et al. disclose other sizing agents may be used together with the acid modified polypropylene resin such as a urethane resin emulsion, an acrylic resin emulsion, and an epoxy resin emulsion. (See [0021])

Hirai et al. and Hasegawa et al. both fail to teach at least 5 wt% of an olefin -based thermoplastic elastomer resin is used. It would have been obvious to one of ordinary skill in the art at the time the invention was made to optimize the resin amount since it has been held that, where the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation. *In re Aller*, 220 F.2d 454, 456, 105 USPQ 233, 235 (CCPA 1955). The burden is upon the Applicant to demonstrate that the claimed resin amount is critical and has unexpected

results. In the present invention, one would have been motivated to optimize the resin amount motivated by the desire to tailor the properties of the final carbon fiber bundle. Hirai et al. discloses the chopped strands have both a high bundling degree and high dispersibility. (See Col 3, lines 40-43) Hasegawa et al. discloses a sizing agent which would enhance the compatibility with the fiber reinforced resin. (See [0030]) As such, examiner has reason to believe that the modified resins of Hirai et al. (i.e. urethane-modified epoxy resin) would provide the claimed Vicat softening point as claimed by applicant, there being no showing of record to prove otherwise.

Regarding claim 9 and 22, Hasegawa et al. discloses the use of a silane coupling agent such as aminosilanes, epoxysilane, and arylsilanes. (See [0021]) Hasegawa et al. discloses the coating weight of a sizing agent is usually between 0.5 to 10%. (See [0023]) Hirai et al. and Hasegawa et al. both fail to teach at 5 wt% or less of silane coupling agent is used. It would have been obvious to one of ordinary skill in the art at the time the invention was made to optimize the silane coupling agent amount since it has been held that, where the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation. *In re Aller*, 220 F.2d 454, 456, 105 USPQ 233, 235 (CCPA 1955). The burden is upon the Applicant to demonstrate that the claimed silane coupling agent amount is critical and has unexpected results. In the present invention, one would have been motivated to optimize the silane coupling agent amount motivated by the desire to tailor the properties of the

final carbon fiber bundle to have increased compatibility with the matrix resin. (See Hasegawa [0030])

Regarding claim 10, Hirai et al. discloses carbon fiber chopped strands are bundled by a sizing agent in an amount of from 1 to 10% by weight. (See Col 3, lines 11-15)

Regarding claim 20, Hasegawa et al. discloses that the acid for modifying the polypropylene resin includes unsaturated dicarboxylic acid, fumaric acid, mesaconic acid, and itaconic acid as well as maleic anhydride, itaconic acid anhydride, anhydrous citraconic acid and mixtures thereof. (See [0011]) Hasegawa et al. disclose other sizing agents may be used together with the acid modified polypropylene resin such as a urethane resin emulsion, an acrylic resin emulsion, and an epoxy resin emulsion. (See [0021]) Hasegawa et al. also discloses that the emulsions may be used together. (See [0021]) Therefore, examiner notes that a compound as claimed by applicant to contain ethylene or propylene, acrylic ester, and an acid anhydride group would have been well within the ordinary skill of one in the art in view of the Hirai et al. and Hasegawa et al. disclosures since the use of more than one resin, whether thermoplastic or thermosetting, modified or not are all contemplated by the prior art.

8. Claims 7 and 19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hirai et al., in view of Rieux et al. (US 3,806,489) as applied to claim 1 above, and further in view of Hino et al. (US 4,371,665)

Regarding claims 7 and 19, Hirai et al. and discloses the use of more than one resin in the sizing agent as set forth above. (See Hirai Col 4, lines 4-21) Rieux et al. further discloses typical examples of such epoxy resin are liquid carboxyl rubbers of the polybutadiene type which contain epoxy group and epoxy compounds resulting from the condensation of dicarboxylic polyesters with polyglycidic derivatives. (See Col 5, lines 3-17) Rieux et al. any of the above types of epoxy resins, or equivalent epoxy resins, can be employed as the sizing agent. (See Col 5, lines 50-53) However, the combined references do not specifically teach a sizing agent comprising at least 40 wt% of a copolymer obtained by copolymerizing ethylene or propylene and an epoxy-containing monomer.

Hino et al. discloses modified epoxy resin composition having excellent flexibility and excellent compatibility with conventional epoxy resins as well as the original properties of the epoxy resin before modified such as mechanical strength, adhesion, heat resistance and chemical resistance. (See Abstract) Hino et al. discloses a process for modifying the epoxy resin for giving thereto other properties without deteriorating the original properties thereof. (See Col 1, lines 4-7) Hino et al. discloses the improved epoxy resin of the present invention is obtained by treating an epoxy resin with at least one modified adduct [D] of a conjugated diene polymer or copolymer which has an imido bond and/or

amido bond and a semicester structure and has an acid value owing to a free carboxyl group of 5 to 100, preferably 10 to 50. (See Col 3, lines 5-10) The modified epoxy resin of the present invention is characteristic in that it has good compatibility with the conventional epoxy resins, such as epi-bis type epoxy resins derived from bisphenol A and epichlorohydrin, polyglycidylether type epoxy resins derived from a novolac resin, polyglycidyl amine type epoxy resins derived from an aromatic amine, and polyglycidyl ester type epoxy resins derived from an aromatic polycarboxylic acid, and that when it is used for coating compositions, it can give cured products having excellent flexibility, such as excellent impact resistance and thermal shock resistance. (See Col 3, lines 40-51) Hino et al. discloses suitable examples of the conjugated diene monomer are butadiene, or the like. Suitable examples of other copolymerizable monomers are vinyl monomers such as acrylic acid esters (e.g. methyl acrylate, ethyl acrylate, etc.), methacrylic acid esters (e.g. methyl methacrylate, ethyl methacrylate, etc.), acrylonitrile, styrene, acetylene, ethylene, propylene, or the like, which may be used alone or in combination of two or more thereof. (See Col 4, lines 12-25) As such, examiner notes that according to the disclosure of Hino et al. a copolymer of ethylene or propylene and an epoxy-containing monomer (and acrylic ester) would be an equivalent to the epoxy sizing agents of Rieux.

As modified Hirai et al. and Hino et al. are both directed to epoxy sizing agents, the art is analogous. Therefore, it would have been obvious to one of ordinary skill in the art to utilize a mixture of components for the sizing agent of Hirai et al. comprising those

components taught by Ricux and/or Hino et al. motivated by the desire to enhance the flexibility, adhesion, etc. of the epoxy resin for use in a molded article. (See Col 3, lines 40-51) Additionally, it would have been obvious to one of ordinary skill in the art at the time of the invention motivated by expected success of enhancing the fiber bundle by modifying the epoxy resins as taught by Hino et al. since Hino et al. discloses a the modified epoxy resin provides additional properties without deteriorating the original properties thereof. (See Abstract and Col 1, lines 4-7) Additionally, it would have been obvious to one of ordinary skill in the art to optimize the weight percent of the copolymer since it has been held that where the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation. *In re Aller*, 220 F.2d 454, 456, 105 USPQ 233, 235 (CCPA 1955).

9. Claims 11 and 24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hirai et al. as applied to claim 1 above, in view of Hasegawa et al. (JP 06-107442), and further in view of Sugiura et al. (JP 2004-011030)

Regarding claims 11 and 24, modified Hirai et al. discloses all of the claim limitations as set forth above but the reference is silent as to the fiber bundle having a mass per unit length of 0.4 to 15 g/m and a width/thickness of 3 to 10.

Sugiura et al. discloses chopped carbon fiber bundles for use in a fiber-reinforced composite material. (See Abstract) Sugiura et al. also discloses the carbon fiber bundle is 0.8-5g/m and it is preferred that the fiber bundle width/thickness at the time of cutting is 3-10. (See [0010])

As modified Hirai et al. and Sugiura et al. are both directed to sized carbon fiber bundles, the art is analogous. Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention motivated by expected success to utilize the dimensions as taught by Sugiura et al. for the carbon fiber bundle of modified Hirai et al. in order to tailor the bundle for end product use such as fiber reinforced composite materials. (See Abstract)

10. Claims 8, 16, 21 and 23 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hirai et al. (US 5,227,238) in view of Rieux et al. (US 3,806,489) as applied to claim 1 above and further in view in view of Ikeda et al. (US 6,569,523).

Regarding claims 8 and 16, modified Hirai et al. discloses all of the claim limitations as set forth above, however the combined references do not disclose wherein the single fibers comprise a plurality of wrinkles.

Ikeda discloses the carbon fiber precursor fiber bundle preferably has wrinkles extending in the longitudinal direction of the fiber bundle on the surface of the monofilament. The

presence of these wrinkles imparts an excellent compactness to the carbon fiber precursor fiber bundle of the present invention, and at the same time, the resultant carbon fiber bundle displays an excellent resin impregnating ability and tow spreading ability. (See Col 7, lines 20-25) Ikeda further discloses the depth of the aforementioned wrinkle is set according to the center line average height (Ra), maximum height (Ry) and interval (S) of the local peaks. (See Col 7, lines 28-30) Ikeda discloses the center line average height (Ra) of the surface of the monofilament of the carbon fiber precursor fiber bundle is preferably 0.01 to 0.1 μm . (See Col 7, lines 31-34) Ikeda discloses the maximum height (Ry) of the monofilament surface of the carbon fiber precursor fiber bundle is preferably 0.1 to 0.5 μm . (See Col 7, lines 53-55) Examiner equates these values to the lowest portions and highest portions of the wrinkles, respectively. Ikeda discloses in addition, the interval (S) between neighboring local peaks which serves as a parameter specifying the interval of these wrinkles is preferably 0.2 to 1.0 μm . (See Col 8, lines 7-10) Examiner notes that Ikeda discloses an average height (Ra) and a maximum height (Ry). Therefore, the difference of the two (i.e. 0.5 μm -0.1 μm), would give a calculated minimal value of $\sim 0.40 \mu\text{m}$. Applicant claims a difference between the highest and lowest portions to be 40nm (i.e. 0.04 μm) or more. While the region is not specifically defined for circumferential length and axial direction length, examiner has reason to believe that one of ordinary skill in the art would have been readily motivated to measure the effect of the wrinkling along the fiber as claimed by applicant. Support for this conclusion is found in Ikeda where a laser microscope is used to determine the difference between neighboring local peaks as well as to measure the maximum heights. (See Figure

2, and Col 8, lines 1-6 and 20-26) Therefore, examiner has reason to believe that the claim limitation is met.

As Hirai et al. and Ikeda et al. are both directed to carbon fiber bundles useful for reinforcing composites having improved dispersibility, the art is analogous. Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention motivated by expected success to provide a wrinkle as taught by Ikeda et al. on the surface of the carbon fibers of Hirai et al. for the purpose of increasing the dispersibility (i.e. tow spreading ability) of the bundle when used in reinforcing composites. (See Hirai Col 1, lines 15-18 and Ikeda Col 3, lines 26-36)

Regarding claim 21, Ikeda discloses the ratio (length/width) of the length and width of the fiber cross section of a monofilament of the acrylonitrile-based polymer according to the present invention is 1.05 to 1.6, preferably 1.1 to 1.3, and more preferably 1.15 to 1.25. (See Col 6, lines 12-19) Ikeda discloses the amount of Si of the carbon fiber precursor fiber bundle is within the range of 500 to 4000 ppm. (See Col 6, lines 47-50) Ikeda discloses the amount of Si can be measured by means of using ICP atomic emission spectrometry. (See Col 7, lines 1-2)

Regarding claim 23, Hirai et al. discloses carbon fiber chopped strands are bundled by a sizing agent in an amount of from 1 to 10% by weight. (See Col 3, lines 11-15)

11. Claims 17 and 18 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hirai et al. (US 5,227,238) in view of Ricux et al. (US 3,806,489) as applied to claim 1 above and further in view in view of Ikeda et al. (US 6,569,523) and Hasegawa et al. (JP 06-107442).

Regarding claims 17-18, modified Hirai et al. discloses the claim limitations as set forth above. However, the combined references do not specifically disclose an acid modified polypropylene resin having a weight average molecular weight of 45,000 or less.

Hasegawa et al. discloses a sizing agent of an acid modified polypropylene resin to be applied to inorganic fiber bundles. (See Abstract and [0004]) Hasegawa et al. discloses the inorganic fiber may be carbon fiber. (See [0022]) Hasegawa et al. discloses the number average molecular weight of the polypropylene system resin was 500-20,000. (See [0007]) Therefore, examiner notes that the average molecular weight as claimed by applicant is met by the prior art. Hasegawa et al. discloses maleic acid may be used to modify the polypropylene resin. (See [0011]) Hasegawa et al. discloses the acid modified polypropylene emulsion may be used alone or may consist of other sizing agents such as vinyl-acetate-resin emulsions, etc. (See [0020]) Therefore, the limitation of at least 35 wt% of an acid modified polypropylene resin sizing agent as claimed is met when the acid modified polypropylene emulsion is used alone and would be easily modified by one of ordinary skill in the art when used together with other sizing agents as

suggested by Hasegawa. Further, as the combined references of Hirai et al. and Hasegawa et al. acknowledge the use of a mixture of sizing agents for a carbon fiber bundle, one of ordinary skill in the art at the time of the invention would have been easily motivated by expected success of improving dispersibility of the bundle to utilize the sizing agents in a 1:1 or (50/50) ratio. Finally, as the limitation of an acid modified polypropylene resin having a weight average molecular weight of 45,000 or less (and 20,000 or less) has been met by the prior art, one of ordinary skill in the art would readily expect that an acid value of 23 to 120 mg KOH/g (and 40 to 75 mg KOH/g) would be exhibited by the sizing agent. Hasegawa et al. discloses the coating weight of a sizing agent is usually between 0.5 to 10%. (See [0023])

As modified Hirai et al. and Hasegawa et al. are both directed to sizing agents for carbon fibers, the art is analogous. Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention motivated by expected success to utilize the acid modified polypropylene resin as taught by Hasegawa et al. as the chosen acid modified polyolefin resin as disclosed by Hirai et al. in order to provide the completely expected result of a sized carbon fiber since Hasegawa et al. showed success. Examiner notes that one skilled in the art would have recognized polypropylene as a readily known polyolefin.

Further regarding claims 17 and 18 Hirai et al. discloses urethane-modified epoxy resins, and epoxy-modified urethane resins may be used in any proportion. (See Col 4, lines 7-

21) Examiner equates the said modified resins to the olefin-based thermoplastic elastomer resin as claimed by applicant. Hasegawa et al. disclose other sizing agents may be used together with the acid modified polypropylene resin such as a urethane resin emulsion, an acrylic resin emulsion, and an epoxy resin emulsion. (See [0021])

Hirai et al. and Hasegawa et al. both fail to teach at least 5 wt% is used. It would have been obvious to one of ordinary skill in the art at the time the invention was made to optimize the resin amount since it has been held that, where the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation. *In re Aller*, 220 F.2d 454, 456, 105 USPQ 233, 235 (CCPA 1955). The burden is upon the Applicant to demonstrate that the claimed resin amount is critical and has unexpected results. In the present invention, one would have been motivated to optimize the resin amount motivated by the desire to tailor the properties of the final carbon fiber bundle. Hirai et al. discloses the chopped strands have both a high bundling degree and high dispersibility. (See Col 3, lines 40-43) Hasegawa et al. discloses a sizing agent which would enhance the compatibility with the fiber reinforced resin. (See [0030]) As such, examiner has reason to believe that the modified resins of Hirai et al. (i.e. urethane-modified epoxy resin) would provide the claimed Vicat softening point as claimed by applicant, there being no showing of record to prove otherwise.

12. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

Double Patenting

13. The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the “right to exclude” granted by a patent and to prevent possible harassment by multiple assignees. A nonstatutory obviousness-type double patenting rejection is appropriate where the conflicting claims are not identical, but at least one examined application claim is not patentably distinct from the reference claim(s) because the examined application claim is either anticipated by, or would have been obvious over, the reference claim(s). See, e.g., *In re Berg*, 140 F.3d 1428, 46 USPQ2d 1226 (Fed. Cir. 1998); *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970); and *In re Thorington*, 418 F.2d 528, 163 USPQ 644 (CCPA 1969).
- A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) or 1.321(d) may be used to overcome an actual or provisional rejection based on a nonstatutory double patenting ground provided the conflicting application or patent either is shown to be commonly owned with this application, or claims an invention made as a result of activities undertaken within the scope of a joint research agreement.
- Effective January 1, 1994, a registered attorney or agent of record may sign a terminal disclaimer. A terminal disclaimer signed by the assignee must fully comply with 37 CFR 3.73(b).

14. Claims 1, 2, and 8 are provisionally rejected on the ground of nonstatutory obviousness-type double patenting as being unpatentable over claims 1 and 5 of copending Application No. 12/500413. Although the conflicting claims are not identical, they are not patentably distinct from each other because they are both explicitly directed to a carbon fiber bundle having a pre-size consisting of an epoxy resin in addition to a size composition comprising the same specifics. Claim 8 of the instant applications and claim 5 of the copending application appear to be directed to substantially the same subject matter with respect to the carbon fiber bundle.

This is a provisional obviousness-type double patenting rejection because the conflicting claims have not in fact been patented.

Conclusion

15. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).
- A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

16. Any inquiry concerning this communication or earlier communications from the examiner should be directed to ALTREV C. SYKES whose telephone number is (571)270-3162. The examiner can normally be reached on Monday-Thursday, 8AM-5PM EST, alt Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Larry Tarazano can be reached on 571-272-1515. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300. Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/D. Lawrence Tarazano/
Supervisory Patent Examiner, Art Unit 1794

/ACS/
Examiner
11/18/09